

## Ambient Ionization, Ion Transport and Ion Mobility-based Detection for Sensing and Identification of Trace Materials

Samar K. Guharay

*The MITRE Corporation, McLean, VA 22102, USA*

*Correspondence: Samar K. Guharay, e-mail: [sguharay@mitre.org](mailto:sguharay@mitre.org)*

Generating intense ions and efficiently transporting these ions to a target form two basic requirements in many critical areas in science and technology including high energy accelerators, thermonuclear magnetic fusion, materials science, semiconductor device fabrication and inspection, and above all, medical applications [1, 2]. Many unique requirements from each of these disciplines engaged researchers over the past decades, and significant progress is noted both on basic problems related to collision processes, formation of ions, and ion dynamics as well as on related technology. Research activities continue to grow in the context of their role in many emerging applications [3]. In this pursuit, advancing the state-of-the art of ion mobility spectrometry (IMS) raises questions related to ionization and ion transport, especially from the standpoint of enhancing its intrinsic merit as an effective and efficient trace/residue sensing technology encompassing both physical and biological sciences. The key components and corresponding functionality of IMS [4,5] are: ionization sources generating ions of ambient (and/or injected) neutral molecules; pulsed injection (or gating) of these ions to a drift medium; transporting ions through a drift cell; and finally, measuring the response of these ions on a Faraday plate detector. Recent activities on modifying the ionization pathway through cluster ion formation shed light on selective ionization and enable manipulating molecular kinetics and enhancing functional attributes of IMS. Space-charge effects [6] constitute an important physics problem in the context of effectively transporting the ions and enhancing sensing capability, from the standpoint of providing high resolving power and sensitivity. This talk will address key questions on ionization problems, effective ion transport and detection. Illustrative examples will highlight different ionization schemes, effective transport approaches and utility of the device for detection and identification of different classes of complex molecules.

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